

**Records of Enchytraeidae (Annelida: Oligochaeta) from west Florida.
1. *Mesenchytraeus*, *Cognettia*, *Bryodrilus*, *Hemienchytraeus*,
Henlea and *Buchholzia***

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Abstract.—Records of eleven species of Enchytraeidae belonging to six genera are given for terrestrial habitats in Florida west of Tallahassee. All are new records for the southern part of North America. A revised diagnosis of *Mesenchytraeus* is provided and a new species, *Mesenchytraeus hamiltoni*, is described which is characterised by the occurrence of secondary pharyngeal glands in V and a very short spermathecal ectal duct. Four species of *Cogettia* occurred, including two new species: *Cognettia floridae* which belongs to the group of species with three pairs of primary and two pairs of secondary pharyngeal glands and male organs in the normal position, and a species for which the description is incomplete. *Bryodrilus novaescotiae*, *Hemienchytraeus stephensoni* and *H. bifurcatus* are fully described and the occurrence of the widespread species *Henlea perpallida*, *H. ventriculosa* and *Buchholzia fallax* is recorded.

The species recorded and described in this paper occurred in four series of collections of Enchytraeidae made in West Florida (west of Tallahassee) during March 1984, April–May 1987, March 1988 and December 1993. Collection procedures and the range of habitats sampled have been described in a previous paper that also contains comments on faunal composition and ecology (Healy 1989). The enchytraeid fauna was found to be rich but patchily distributed. Among the 70–75 taxa recognised were at least 24 species believed to be new to science, a further 10 species new to North America and 18 already known from the continent but new to Florida. The large number of new species and new regional records is explained by the fact that there have been few studies of enchytraeids in North America and almost none in the Southeast. The only enchytraeids previously recorded from Florida are two species of *Grania* from the marine sublittoral on the Atlantic coast (Kennedy 1966, Coates &

Erséus 1985), *Stephensiella marina* from the marine littoral on Virginia Key (Coates 1983) and the freshwater species *Barbidrilus paucisetosus* from the Appalachian River (Loden & Locy 1980). There are no records of terrestrial species.

This paper records details of 11 terrestrial species belonging to six of the 13 genera found in West Florida. Most of the previously known species were originally described from European populations, thus some morphological differences are to be expected in North American specimens. When Florida specimens depart from the original descriptions or those of European material as given by Nielsen & Christensen (1959), these differences are noted. A full description of *Bryodrilus novaescotiae* is given because the original description was based on a small number of fixed specimens only. *Hemienchytraeus stephensoni* and *H. bifurcatus* are also fully described, extending the known range of variability in these widespread species.

Materials and Methods

Samples were collected from a wide range of habitats, particularly moist or wet humus in woodlands or swamps, and soil from capillary zones at the edge of water bodies such as bayheads, ponds and streams. Enchytraeids were absent or in poor condition in dry soils and rare in submerged substrates where they were generally replaced by Tubificidae. The species described in this paper occurred at nine localities.

Worms were extracted from soil samples using the wet funnel method which uses light and heat from light bulbs to expel worms from samples into water-filled funnels (O'Connor 1955, Healy & Rota 1992). Some specimens of all species were examined live and measurements of live worms or their organs were made on worms lightly compressed under a cover slip. Other material was fixed in 70% ethanol or Bouin's fixative and stored in 70% ethanol. Most specimens were stained in paracarmine and whole-mounted in Canada Balsam but a few unstained mounts were also prepared.

Type specimens and other material have been deposited in the United States National Museum of Natural History, Washington D.C. (USNM) and a few specimens are in the Royal Ontario Museum (Invertebrate Zoology), Toronto (ROMIZ).

Genus *Mesenchytraeus* Eisen, 1878

Mesenchytraeus Eisen, 1878:67.

Analycus Levinsen, 1884:230.

Mesenchytraeus Eisen 1879:10, 1904:14–17; Michaelsen 1887:369–372, 1889:15–16; Čejka 1914:5; Welch 1920:42–44; Černosvitov 1937a:278; Nielsen & Christensen 1959:30–31.

Type species.—*Mesenchytraeus primaevus* Eisen, 1878.

Following the listing of Eisen's species *M. primaevus*, *M. mirabilis* and *M. falciformis* (Eisen 1878) as species dubia by Nielsen & Christensen (1959), Brinkhurst

& Jamieson (1971) designated *Analycus* Levinsen, 1884 as the correct name for the genus on grounds of priority. However, Piper et al. (1982) re-examined Eisen's material and concluded that the specimens were undoubtedly members of *Mesenchytraeus* although their poor condition precluded the distinction of specific characters. As the original descriptions were deemed adequate, they therefore restored the name *Mesenchytraeus* designating *M. primaevus* as type species.

Diagnosis.—Medium to large worms, usually white but sometimes yellow due to colored coelomocytes or black when the epidermis is pigmented. Setae sigmoid, distinctly nodulated or with slight swellings. Head pore at or near the apex of the prostomium. Clitellum well developed, sometimes extends over several segments. Paired pharyngeal glands on septa at 4/5 and 5/6, secondary pharyngeal glands, when present, ventral in two to five segments. Transition between esophagus and intestine gradual. Peptonephridia absent. Esophagus and intestine without diverticula or appendages. Dorsal vessel originates in, or more usually behind, clitellum. Coelomocytes of one type, nucleate, rather small for the size of the worm, round, oval or spindle-shaped. Nephridia with poorly developed interstitial tissue, allows the coils of the canal to be seen clearly, preseptale consisting of a nephrostome on a short or long neck, post-septale with two or three lobes. Brain rather short, often broader than long, its anterior border indented or cleft. Paired seminal vesicles usually present, sometimes extending within the egg sac into post-clitellar segments. Sperm funnel small, barrel-shaped or cylindrical. Sperm duct often enlarged to form an atrium just before it enters penial bulb. Atrial glands (prostates) and penial glands present or absent. Egg sac present, often extends through several segments behind clitellum. Spermathecae simple or with diverticula, free or fused to esophagus.

Remarks.—The above diagnosis is a

modified version of those given by Eisen (1878, 1879, 1904), and Nielsen & Christensen (1959), and takes into account more recent descriptions. Nodulated setae were considered diagnostic by Nielsen & Christensen but were not mentioned by Eisen, either in his generic diagnoses or in any of his detailed species descriptions. Subsequent reviews of the genus (e.g., Michaelson 1887, 1889; Čejka 1914, Welch 1920, Černosvitov 1937a) similarly omitted mention of the character. Re-examination of the material described in Eisen's 1878 paper by Piper et al. (1982) confirmed the presence of noduli in all three species and it must be assumed that the character was overlooked by early workers. The nodulus may be very weak, however, and may be represented by little more than a slight swelling, as in the new species described below, making it difficult to recognise for an inexperienced worker. A nodulus is unusual in enchytraeids and is present in only one other genus. However, reliance should not be placed on this character when constructing or using keys to genera. Other modifications of existing diagnoses concern the postseptal regions of the nephridia, which Nielsen & Christensen describe as bilobed but which frequently have three lobes, and the egg sac, which Eisen describes as single and median but which may extend backward as two distinct sacs. Eisen (1904) described the penial bulb as a muscular cushion containing radiating muscular strands, which in some species are powerful and usually contain internal glands (penial glands), but the bulb structure is variable and the whole structure may be quite compact. Although not always present, an atrium, formed by expansion of the sperm duct at the entrance to the penial bulb, sometimes with attached glands, is unique in the Enchytraeidae. None of the characters proposed by Eisen (1878, 1879) as grounds for erecting the new genus has proved to be useful; these are: the presence of sperm balls or spermatophores in the coelom (not recorded in any other enchytraeid genus but only pres-

ent in some *Mesenchytraeus* species), brain deeply divided in front (not unique to *Mesenchytraeus*, indentation sometimes shallow), and an unusually short vas deferens (usually short but not always exceptionally so). Cardiac glands (Herzkörper of Michaelsen), mentioned by early workers, are internal structures in the dorsal vessel, not easily detected in whole mounts. In practice, the most reliable character that distinguishes *Mesenchytraeus* is the nephridium with its free nephrostome (also found in some other genera), poorly developed interstitial tissue and lobed postseptale. In live worms, the nephridia have a very distinctive appearance that makes *Mesenchytraeus* specimens instantly recognisable.

Distribution.—Eisen (1904) described 18 species of *Mesenchytraeus* from western parts of North America (mainly Alaska and California) and a further ten species have been described from western regions by other workers; in contrast, only three species are recorded from the eastern part of the continent (Tynen 1975). The genus also appears to be well represented in Siberia (Nurminen 1973a, Piper et al. 1982, Timm & Popchenko 1978, Timm 1994) while only eleven species are recognised in Europe. Very few species have been found in the tropics. The genus thus appears to have its present centre of distribution in northern regions of the western Nearctic and eastern Palearctic. The poor representation in West Florida, where only one species was at all frequent, supports this view.

North America, South America, Greenland, Europe, Spitzbergen, Siberia, Japan, Antarctic, ?Africa.

Mesenchytraeus hamiltoni,
new species
Fig. 1

Material examined.—Holotype: USNM 170722 whole mounted specimen from edge of "sewage pond", University of West Florida, Pensacola, collected by author, December 1993. Paratypes from the type lo-

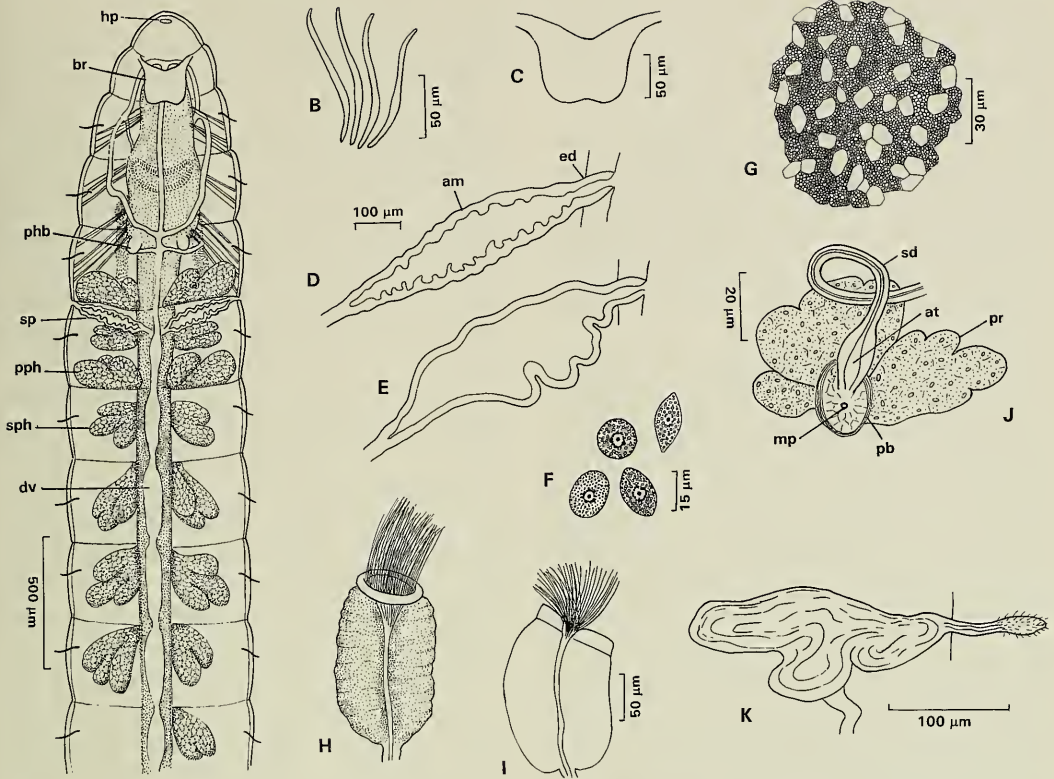


Fig. 1. *Mesenchytraeus hamiltoni*, new species. A, anterior segments, dorsal view; B, dorsal setal bundle; C, brain; D, spermatheca of live worm, contracted; E, spermatheca of live worm, expanded; F, coelomocytes; G, dorsal clitellar gland cells and clear interspaces; H, sperm funnel, live specimen; I, sperm funnel, fixed specimen; J, male pore and associated structures; K, nephridium. am ampulla, at atrium, br brain, dv dorsal vessel, ed ectal duct, hp head pore, mp male pore, pb penial bulb, phb pharyngeal bulb, pph primary pharyngeal gland, pr prostate, sd sperm duct, sp spermatheca, sph secondary pharyngeal gland.

cality: USNM 170723–170726, two stained and two unstained whole mounts, one with clitellum partly removed. Other material: seven whole mounts in author's collection. Approximately 16 live mature specimens examined.

Type locality.—Wet or saturated peaty sand with moss and plant roots at edge of a pond receiving clean water from a sewage treatment plant, water level constant. pH 4.5–5.3.

Etymology.—The species is dedicated to Professor Paul Hamilton of the University of West Florida who introduced me to many interesting and rewarding localities.

Description.—Medium to large, white, yellowish or pink worms; live specimens

18–30 mm, 0.7 mm in diameter. Fixed specimens often much contracted, mature individuals measuring 8–22 mm with a prominent clitellum up to 1.2 mm in diameter. Segments in mature specimens 55–86 ($\bar{X} = 66$, $SD 7.9$, $n = 11$), 55–75 in submature ones. Setae sigmoid with nodulus poorly developed or absent, without ental hook (Fig. 1B), 108–120 μm in the preclitellar region, 120–144 μm in posterior segments. Lateral bundles with three or four setae, ventral bundles with 3–12 in preclitellar segments, 3–11 behind the clitellum, setae about equal in length within bundle. Setae absent dorsally in XII and XIII, occasionally present ventrally in XII, reduced in number or absent ventrally in XIII. Cu-

taneous glands in two or three rows at about the level of the setae, or scarcely visible. Clitellum extends from $\frac{1}{2}$ XI to $\frac{3}{4}$ or all of XIII with numerous small gland cells containing coarse granules, irregularly scattered with clear interspaces, that mask internal organs in live as well as stained specimens (Fig. 1G). Gland cells may be almost continuous ventrally in fully mature individuals. Head pore at, or near, tip of prostomium.

Primary pharyngeal glands on 4/5 and 5/6 free dorsally, either unlobed or with two or three lobes; secondary glands, each with several lobes, situated ventrally in V, VI, VII and usually in VIII (Fig. 1A). A few specimens had either one or two glands in IX and one individual possessed a lobed gland unilaterally in X (Fig. 1A). Two small bulbs on dorsal posterior border of the pharynx in IV (Fig. 1A). Chloragocytes small, brown, present from IV, form a dense layer from VIII, 12–16 cells across the intestine in the preclitellar region in mounted specimens. Esophagus merges with intestine without increase in diameter, intestine enlarges behind origin of dorsal vessel. Coelomocytes 14–30 μm , oval or spindle-shaped, with rather coarse granules and a weakly staining nucleus (Fig. 1F). Dorsal vessel originates in XI–XIII with dilatations in VII–XII and conspicuous branches in II and III (Fig. 1A); bifurcation anterior to brain. Blood faintly or distinctly red. Brain about as broad or slightly broader than long, about 80 μm in length, truncated or slightly indented posteriorly, deeply indented on its anterior border (Fig. 1C). Nephridial nephrostome elongated, on a long neck, postseptale with two or three lobes; efferent duct arises mid-ventrally (Fig. 1K). First nephridia at 6/7, occasionally at 5/6.

Testes large and spongy in mature worms, appear brown by transmitted light in living specimens. Seminal vesicles paired, confined to XI or extend into X. Sperm funnels small, barrel-shaped, 120–160 μm in length, about 1.5 times as long as wide, with a raised collar about as wide

as the funnel in fixed specimens, appearing slightly narrower in live worms (Fig. 1H, I). Sperm duct 14–16 μm wide, about ten times length of funnel, loosely coiled in XII. Male openings irregular or semicircular slits. Each sperm duct widens distally to form a thick-walled, fusiform atrium that opens centrally into penial bulb; three large, slightly lobed glands attached to bulb (Fig. 1J). Two egg sacs develop asymmetrically on 11/12 as pouches, each containing a string of oocytes and eggs, reaching to XVIII on one side. Ovarian tissue diffuse, extending back in egg sacs which develop before sperm funnels and ducts. Up to five mature eggs present at a time. Spermathecae simple, without diverticula, each consists of an elongated ampulla that tapers entirely to merge with esophagus in V and ectally to a short ectal duct, only a little longer than wide, scarcely longer than thickness of body wall (Fig. 1D, E). Ampullae expand and contract and occasionally pulsate. When contracted, wall becomes rugose or folded internally (Fig. 1D). Only small amounts of sperm, arranged lengthwise, in ampulla. Spermathecae develop early and are fully formed in specimens only half the final size and in which there are no signs of male organs or oocytes.

Remarks.—Among the ten or so described species of *Mesenchytraeus* with spermathecae attached to the esophagus in V, but which lack diverticula, *M. hamiltoni* is unique in the shortness of the ectal duct of its spermatheca and in the presence of secondary pharyngeal glands in V. These features are deemed sufficient to characterise the species although details of structures associated with the male opening, often an important diagnostic character in the genus, have not been described for most of the species with which it might be compared. *Mesenchytraeus hamiltoni* most resembles *M. glandulosus* (Levinsen, 1884) which has five pairs of secondary pharyngeal glands but has a spermathecal ectal duct equal in length to one third of the ampulla, lacks secondary pharyngeal glands in V and has

a nephridial funnel without a neck. The number of pharyngeal glands was variable for individuals of the same size and stage of maturity.

Although the species was plentiful at the type locality and at several other sites, mature specimens were rare. None was found in March 1984, only four in April–May 1987, three in March 1988 and seven in December 1993. A low proportion of adults in populations is common in the genus (personal observation).

Habitat.—*Mesenchytraeus hamiltoni* was common in the Pensacola region and was sometimes the dominant enchytraeid in wet substrates. It occurred in a variety of habitats including woodland leaf litter in valleys and swamps, *Sphagnum* and pitcher plant (*Sarracenia*) bogs, and saturated soils at the edge of water bodies where the highest densities occurred. At the latter sites they were often accompanied by Tubificidae. The pH range was 3.9–5.8.

Distribution.—In and around the campus of the University of West Florida, Pensacola; Blackwater Forest, at the edge of a swamp; Avalon Peninsula, edge of a pitcher plant (*Sarracenia*) bog; Lakewood, among *Sphagnum* and grassroots at edge of lake. Not found in the east of the study area.

Mesenchytraeus sp.

Material examined.—Seven live, immature specimens.

Remarks.—A somewhat yellowish species was present at several hardwood forest sites but no fully mature specimens were available for a definitive identification. Specimens had two pairs of primary and two pairs of secondary pharyngeal glands and spermathecae communicating with the esophagus in V, each with a pair of elongated diverticula. The species resembles *M. beumeri* (Michaelsen, 1886) in general appearance.

Habitat and distribution.—In hardwood leaf litter. Occasional at the University of West Florida, Pensacola and in Torreya

State Park; common at Tall Timbers Forest Research Station.

Genus *Cognettia*

Nielsen & Christensen, 1959

Cognettia species are recognised by sigmoid setae, without nodulus, in bundles of two or three; nephridia with preseptale consisting of funnel only and an antero-ventral or mid-ventral origin of the efferent duct; absence of peptonephridia; absence of esophageal and intestinal diverticula; dorsal vessel originating in or behind clitellum; a simple penial bulb and a simple spermatheca, not attached to the oesophagus. Testes, ovaries and male pores may be displaced forward by up to four segments.

Distribution.—The only record of *Cognettia* in North America is for *C. glandulosa* from Montreal, Canada (Nurminen 1973b). The genus has proved so far to be characteristic of wet, acid soils in cold or cold-temperate lands and members are usually the dominant enchytraeids in tundra and coniferous forests of northern Europe. However, the discovery of four species in Florida shows that *Cognettia* species can survive in a warm climate while the presence of two new species suggests that North America, like Europe, may have its own endemic species.

Canada, Greenland, Europe, Spitzbergen, Siberia, Japan, Ecuador, Antarctic.

Cognettia floridae, new species

Fig. 2

Material examined.—Holotype: USNM 170727, stained whole mount, Edward Ball Nature Trail, University of West Florida, Pensacola, a hardwood, bayhead swamp, collected by the author April 1987. Paratypes from the type locality and other sites in the University of West Florida: USNM 170728–170732, two stained and two unstained whole mounts. Other material: ROMIZ 13242–13243, stained whole mounts; 11 whole mounts in the author's collection; 42 live specimens examined.

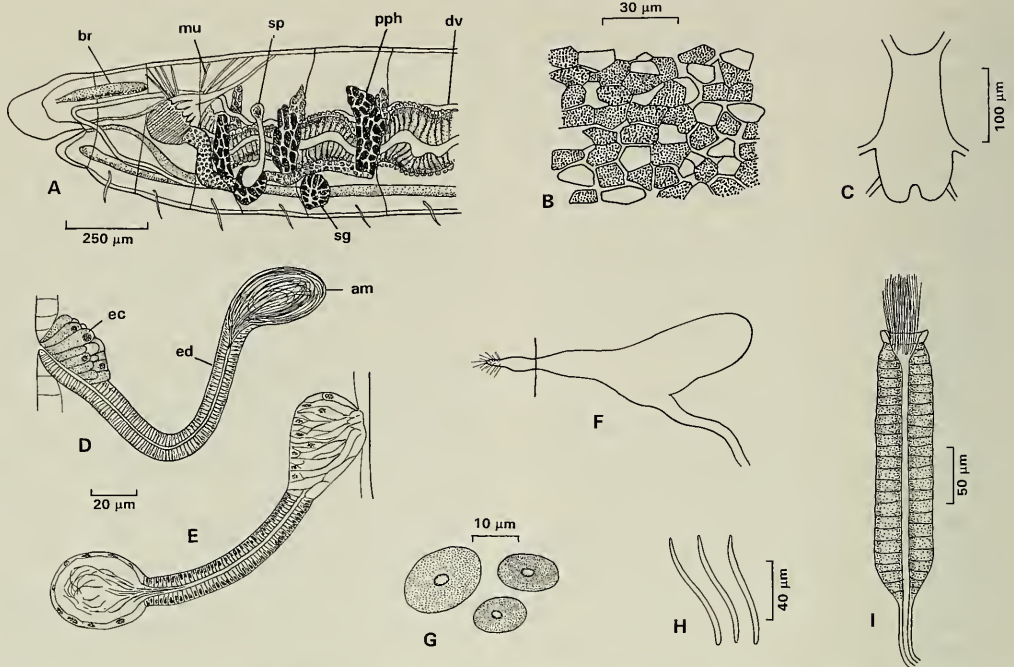


Fig. 2. *Cognettia floridiae*, new species. A, anterior segments, lateral view; B, dorsal clitellar gland cells and clear interspaces; C, brain; D, spermatheca of live worm; E, spermatheca of fixed specimens; F, nephridium; G, coelomocytes; H, setae; I, sperm funnel, live worm. am ampulla, br brain, dv dorsal blood vessel, ec ectal glands, ed ectal duct, mu muscle; pph primary pharyngeal gland, sg secondary pharyngeal gland, sp spermatheca.

Type locality.—In moist, wet or saturated sandy humus under *Taxodium* and hardwood trees in a partly tidal, freshwater bay-head swamp; some areas subject to periodic flooding. pH 3.9–4.7.

Etymology.—Named after the State of Florida, genitive case.

Description.—Live specimens greyish-white, 7–9 mm, fixed specimens 5–9 mm, diameter 0.5–0.52 mm, 0.56 mm at clitellum. Segments (29)39–46 (\bar{X} 40.9, $SD = 3.6$, $n = 23$). Setae without ental hook (Fig. 2H), 80–96 μ m in preclitellar region, 80–104 μ m in posterior segments, three per bundle in all regions, occasionally only two, setae absent in XII. Cutaneous gland cells small, in numerous rows or more or less scattered. Clitellum prominent in live worms, extending over XII–XIII with squarish gland cells arranged in transverse rows. In stained mounts, the gland cells, which are packed with coarse granules, are

irregularly scattered with clear interspaces, absent mid-ventrally (Fig. 2B). Head pore at 0/1.

Three pairs of primary pharyngeal glands, all free dorsally, without ventral lobes, and two pairs of compact secondary glands, situated ventrally in V and VI (Fig. 2A). Esophagus merges gradually with intestine from 6/7. Chloragocytes present from IV, forming a dense layer from VI, 10–12 across intestine in preclitellar region in compressed specimens. Dorsal vessel arises at 13/14, occasionally in XIV or XV, anterior vessel bifurcates at level of 0/1. Blood colorless in specimens from drier habitats, faintly or distinctly red in those from wet substrates. Coelomocytes round or oval, finely granular with a prominent nucleus (Fig. 2G), 14–32 μ m long, about a quarter of length of setae. Nephridial nephrostome on a short neck, long efferent duct arises antero-ventrally or mid-ventrally

(Fig. 2F). First nephridium at 6/7. Brain 160–200 μm long, 1.5–2 times longer than wide, deeply incised posteriorly (Fig. 2C).

Seminal vesicle unpaired, dorsal, confined to XI. Sperm funnels small, cylindrical, in live worms about 100 μm long, four or five times longer than wide, equal to about $\frac{1}{4}$ – $\frac{1}{3}$ diameter of live worm (Fig. 2I). In fixed specimens, length usually about $\frac{1}{4}$ of worm diameter. Collar slightly narrower than funnel. Sperm duct long and narrow, diameter 6 μm , coiled in XII, opens through a compact penial bulb, greatest diameter about 90 μm , which occupies $\frac{1}{6}$ to $\frac{1}{5}$ of the diameter of clitellum in mounted specimens. One, or usually two, eggs present at a time. Spermathecae confined to V. Ectal ducts thick-walled, about four times length of ampullae, each with a mass of fused, elongate cells on anterior face, near opening (Fig. 2D, E). Ampulla dorsal to oesophagus in V, thin-walled, 35–50 μm long, 1.2 times longer than wide, with most of sperm arranged lengthwise and extending into proximal part of ectal duct in most specimens (Fig. 2D, E).

Remarks.—*Cognettia floridae* belongs to a group of species that comprises *C. cognettii* (Issel, 1905), *C. lapponica* Nurminen, 1965, *C. hibernica* Healy, 1975 and *C. zicsii* Dózsa-Farkas, 1989 all of which reproduce sexually and have reproductive organs in the normal position for Enchytraeidae. It resembles *C. lapponica*, *C. hibernica* and *C. zicsii* in having three pairs of primary pharyngeal glands and two pairs of secondaries and spermathecae confined to V but it is unique in the asymmetrical ectal swellings on the spermathecal ducts.

Habitat.—The species was common in and around the campus of the University of West Florida and plentiful at two other localities. It was found in a range of substrates including sandy peat and peaty sand, *Sphagnum*, coniferous and broad-leaved leaf litter, finely divided humus and among roots of aquatic plants at the edge of water bodies. All sites were wet, saturated or flooded, with pH levels 3.9–4.5, among the

lowest for the region. Mature individuals were common.

Distribution.—Pensacola, campus of the University of West Florida; Avalon Peninsula, pitcher plant (*Sarracenia*) bog; Lakewood, edge of a lake. Not found in the eastern part of the study area.

Cognettia sp.

Fig. 3

Material examined.—Two live mature specimens collected in April 1984 were available for the following description but both were damaged during examination and no further mature individuals could be found. The remaining material consists of one stained, whole-mounted, submature specimen, USNM 170732, three stained whole mounts of immature specimens USNM 170733–170735 and ten whole mounts of immatures in the author's collection. Approximately 30 live, immature individuals were also examined.

Description.—Medium sized, rather slender worms, creamy white, internal organs partly masked by abundant coelomocytes in live worms. Length of live, mature specimens 10–12 mm; live, non-fragmenting immatures reach 20 mm. Maximum length of fixed immature specimens 12 mm, diameter 0.28–0.37 mm. Segments 50 and 58 in the mature specimens but reach 64 in immatures. Setae without ental hook, 68–84 μm in all regions, three ventrally, three or sometimes two laterally. Setae absent from IX or X in mature individuals. Clitellum only slightly raised, extends over IX– $\frac{1}{2}$ X (over X– $\frac{1}{2}$ XI in submature specimen), gland cells irregularly scattered or partly in transverse rows (Fig. 3D). Male pores in X or XI. Cutaneous glands small, in numerous rows or scarcely visible. Head pore at, or just anterior to 0/1.

Five pairs of unlobed, primary pharyngeal glands in large individuals but fifth pair often small, developing unilaterally or absent (Fig. 3G). Only four pairs in mature worms. Anterior glands may be united dor-

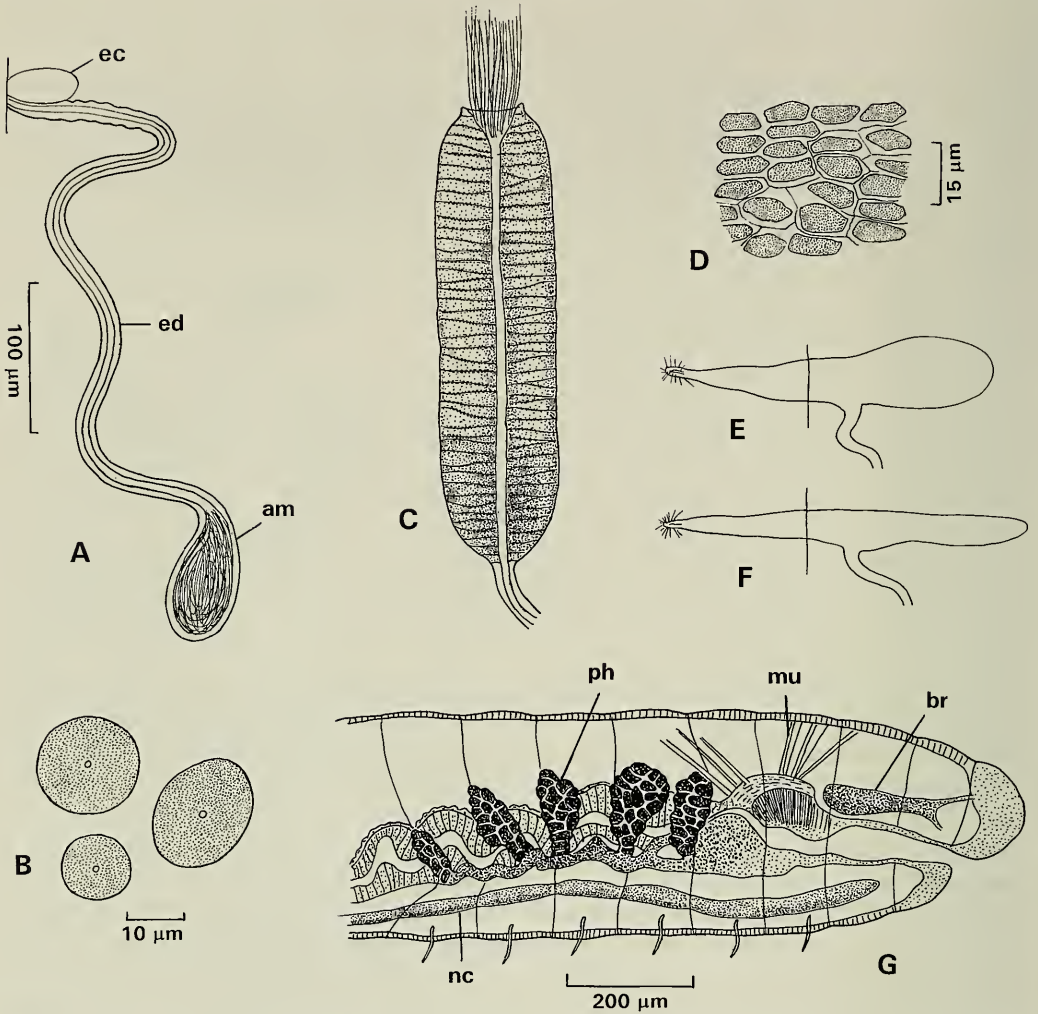


Fig. 3. *Cognettia* sp. A, spermatheca, live worm; B, coelomocytes; C, sperm funnel, live worm; D, clitellar glands; E, preclitellar nephridium; F, postclitellar nephridium; G, anterior segments, lateral view. am ampulla, br brain, ed ectal duct, eg ectal gland, mu muscle, ph pharyngeal gland, nc ventral nerve cord.

sally while posterior ones are usually free. Secondary pharyngeal glands absent. Esophagus merges gradually with intestine. Chloragocytes present in a dense layer from behind last pair of pharyngeal glands i.e., in VIII or IX, 10–14 across the intestine in compressed specimens. Dorsal vessel from XIV or XV, anterior bifurcation just behind 0/1. Blood colorless or faintly red. Coelomocytes 20–30 μm , round or oval with a sharp outline, packed with fine granules that make them appear brown by transmitted light in living worms (Fig. 3B). They are

usually very abundant, often so densely packed as to mask internal organs. Nephridia with free nephrostome and elongate pre-septale, efferent duct long, arising antero-ventrally or mid-ventrally (Fig. 3E, F). Brain about 1.5 times longer than broad with a truncate or sinuous posterior border.

Seminal vesicle present, unpaired. Sperm funnels cylindrical, about four times longer than wide, each with narrower, scarcely raised, collar (Fig. 3C). Sperm ducts long and narrow, opening at compact penial bulbs. Spermathecal ectal ducts long, slen-

der, without swellings, leading to ovoid ampullae in VII (Fig. 3A). One large ectal gland anterior to each spermathecal opening.

Remarks.—The above description is incomplete owing to the shortage of mature specimens but the distinctive appearance of live individuals made them easily recognizable in samples, even as immatures, and there seems little doubt that this is a new species. Many worms were regenerating anterior or posterior segments and the species obviously reproduces principally by fragmentation; sexual individuals were rare in the population. The species is close to *C. sphagnetorum* (Vejdovský, 1878) which reproduces in the same way and which also has four or five pairs of primary pharyngeal glands and no secondary glands. *Cognettia sphagnetorum*, however, has a chamber containing a ring of sperm at the junction between the ectal duct of the spermatheca and the ampulla and more anterior male openings (in VIII or IX). Other *Cognettia* with displaced reproductive organs, namely *C. glandulosa* (Michaelsen, 1888), *C. paxi* (Moszyński, 1938) and *C. anomala* (Černosvitov, 1928), all have secondary pharyngeal glands. While there are no important diagnostic differences between immature forms of *C. sphagnetorum* and the present species, the abundant coelomocytes with sharp outline and densely granular cytoplasm give the Florida species a distinctive appearance.

Habitat and distribution.—University of West Florida, Pensacola, in the drier parts of a bayhead swamp and in an adjoining ravine with hardwoods. Common in moist, but not wet, leaf litter and humus, pH 3.6–4.5, above the zone subject to periodic flooding.

Cognettia ?sphagnetorum
(Vejdovský, 1878)

Pachydrilus sphagnetorum Veydovský 1878:
304.

Cognettia sphagnetorum Nielsen & Chris-

tensen 1959:42–43, figs. 28, 29; Kasprzak 1986:124–125, figs. 332–334; Chalupský 1992:142, fig. 10.

Material examined.—Two stained, whole-mounted immature specimens in the author's collection. Three live immature specimens examined.

Remarks.—The absence of mature individuals makes a definitive identification impossible, but specimens resembled *C. sphagnetorum* from Ireland in general appearance although they had only four pairs of pharyngeal glands. Nielsen & Christensen (1959) give five pairs for Danish material, except in mature individuals, but I have found in Irish populations that the fifth pair is often absent in fragmenting individuals. Fragmentation is the normal method of reproduction in *C. sphagnetorum* and sexual individuals are always rare. Material from Florida included one specimen with a developing clitellum and one which appeared to be a juvenile, with only 20 segments, although according to Christensen (1959) the species does not seem to be capable of producing viable eggs.

Habitat and distribution.—Lakewood, among grass roots and leaf litter at the edge of a lake, pH 4.2–4.4. Europe, Iceland, Spitzbergen, Antarctic. (Some of these records are based on immatures only.)

Cognettia ?glandulosa
(Michaelsen, 1888)

Pachydrilus sphagnetorum var. *glandulosus*
Michaelsen, 1888:483.

Marionina glandulosa Issel 1905:455–456,
fig. 3.

Enchytraeoides glandulosus Černosvitov
1928:16–17, Pl. 1, figs. 10, 11.

Cognettia glandulosa Nielsen & Christensen 1959:43–44, fig. 30; Kasprzak 1986:
125–126, figs. 335–337.

Material examined.—USNM 170736–170737, two stained, whole-mounted immature specimens; two whole mounts in the author's collection; five live, immature individuals examined.

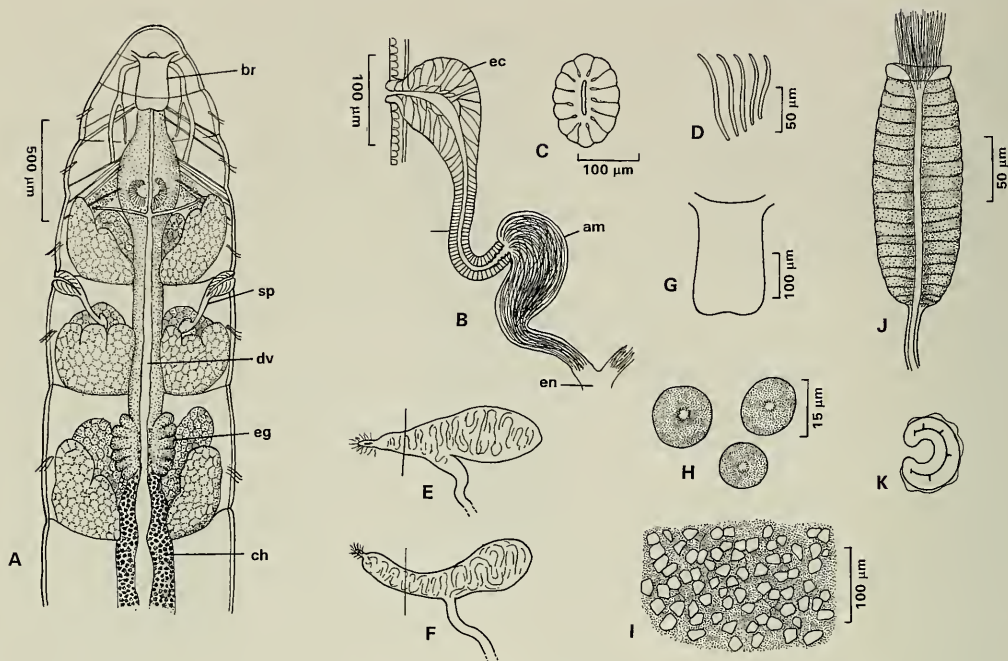


Fig. 4. *Bryodrilus novaescotiae*. A, anterior segments, dorsal view; B, spermatheca, live worm; C, spermathecal pore, surface view; D, setal bundle; E, preclitellar nephridium; F, postclitellar nephridium; G, brain; H, coelomocytes; I, clitellar glands, dorsal view; J, sperm funnel, live worm; K, male pore, ventral view. am ampulla, br brain, ch chloragocytes, dv dorsal blood vessel, ed ectal duct, ec ectal glands, en ental duct, eg esophageal gland, sp spermatheca.

Remarks.—The distinctive feature of this species is the presence of five pairs of primary and five (occasionally four) pairs of secondary pharyngeal glands. Immature specimens are commonly identified on the basis of this character alone. The spermatheca is also distinctive. No sexual individuals were found, however, during this survey, thus a positive identification is not possible. Specimens resembled *C. glandulosa* from Ireland in general appearance. The presence of regenerating fragments indicated that individuals were reproducing by fragmentation.

Habitat and distribution.—Ponce de Leon, leaf litter on floodbank of stream issuing from limestone, pH of litter 5.34. Canada, Greenland, Iceland, Europe, Siberia, Antarctic.

Genus *Bryodrilus* Ude, 1892

Diagnostic characters of the genus are sigmoid or curved setae, without nodulus,

of different sizes within a bundle; four esophageal diverticula in VI; peptonephridia and intestinal diverticula absent; dorsal vessel originates within or behind the clitellum; coelomocytes of uniform size and shape; preseptale of nephridium consists of funnel only, efferent duct arises anteriorly, near the septum ("Henlea type") or medially; compact penial bulb; simple spermathecae whose ental ducts usually unite before communicating with the dorsal wall of the esophagus.

Distribution.—So far confined to the northern Holarctic, the majority of species being recorded from North America and Siberia. Alaska, Canada, Greenland, Europe, Siberia.

Bryodrilus novaescotiae

Bell, 1962

Fig. 4

Bryodrilus novaescotiae Bell, 1962:169–171, Pl. iv, figs. 1–9.

Material examined.—Three stained whole mounts USNM 170746–170748; three stained whole mounts ROMIZ 13241, 13244–13245, 17 whole mounts in the author's collection. Approximately 30 live specimens examined. Type material not located.

Description of new material.—Medium to large species, white or yellowish due to color of chloragogen tissue and abundant coelomocytes. Length variable; live specimens 10–20 mm, reach 30 mm when stretched; fixed specimens 8–16 mm, diameter 0.7–0.8 mm, slightly wider at clitellum. Segments (37)45–64 ($\bar{X} = 54.2$, $SD = 5.5$, $n = 19$). Setae sigmoid, without ental hook, three or four in lateral bundles, five or six (occasionally seven) in anterior ventral bundles, four to six ventrally behind clitellum (Fig. 4D). Setae diminish in size from outside of bundle to mid-line and measure 50–100 μm in preclitellar region, 112–128 μm in posterior segments. Cutaneous gland cells in about ten rows anteriorly, more noticeable at level of setae, eight or nine rows per segment behind clitellum. Clitellum extends over XII and $\frac{1}{4}$ – $\frac{3}{4}$ XIII, only slightly raised, with numerous small, coarsely granular, irregularly scattered gland cells and polygonal interspaces (Fig. 4I). Ventrally, gland cells nearly continuous. Head pore a transverse slit just anterior to 0/1.

Three pairs of lobed pharyngeal glands, all free dorsally and with ventral lobes (Fig. 4A). Four esophageal glands in VI, closely applied to the esophagus, situated dorso-laterally and ventro-laterally, each with five to seven regular lobes (Fig. 4A), apparently solid, no internal canals seen. Chloragocytes small, average 10–15 in number across intestine in compressed specimens, form a dense layer from 6/7 at point where gut widens gradually. Coelomocytes numerous, round or oval, finely granular, nucleus not visible in live worms but distinct when stained, diameter (16)20–42 μm (Fig. 4H). In live individuals, coelomocytes appear brown by transmitted light. Dorsal vessel

originates at 11/12 or sometimes 12/13, with segmental dilatations in VI–XI, anterior bifurcation at 0/1. Blood colorless. Nephridia with small, free nephrostome and elongate preseptale, postseptale with long, narrow efferent duct that arises antero-ventrally in preclitellar region, mid-ventrally in posterior segments (Fig. 4E, F). First nephridium at 6/7. Brain usually about 1.5 times longer than wide but sometimes shorter with a sinuous posterior border and straight or indented anterior border (Fig. 4G).

Testes small, oval and compact with a smooth outline. Seminal vesicle unpaired, confined to XI. Sperm funnels cylindrical or taper distally, each with a distinct collar of about same width as funnel (Fig. 4J), length in live specimens 150–180 μm , three or four times longer than wide, up to five times longer when stretched, equal to $\frac{1}{4}$ to $\frac{1}{3}$ of diameter of worm. In mounted specimens, funnel has a smooth outline and is usually bent into a semicircle. Sperm duct long and narrow, coiled in XII, about 6 μm in diameter; each opens through a large but compact penial bulb, about 60 μm in longitudinal diameter but sometimes smaller. In fixed specimens, bulb occupies about $\frac{1}{3}$ of diameter of clitellum. Male openings semicircular slits (Fig. 4K). One egg present at a time. Spermathecae large, more or less confined to V (Fig. 4B). Ectal duct of spermatheca composed of two parts roughly equal in length, a stout, thick-walled section communicating with one side of ampulla, and a large, bulbous, asymmetrical mass of cells surrounding a narrow chamber that opens to the outside through a straight or curved slit at 4/5, surrounded by a protruding ring of large cells forming a rosette at the surface up to 190 μm across (Fig. 4C). Ampulla thin-walled, roughly pear-shaped in live specimens but contracting to become more spherical when fixed. Ampullae taper entally, ental ducts usually unite just before communicating with esophagus at 5/6 or in anterior part of VI (Fig. 4B), but occasionally communicate separately. Ampullae and

ental ducts contain abundant sperm, mostly arranged lengthwise.

Remarks.—The distinctive character of *B. novaescotiae* is its spermathecae. The large swellings near the openings of the ectal ducts are not present in any other member of the genus. Bell (1962) also considered the solid esophageal glands to be unique as they are hollow in other species. His specimens differed chiefly in the form and dimensions of the spermathecae, each of which had a large, hemispherical chamber in the ectal bulb, a smaller "spherical" ampulla and a longer common ental duct. He mentioned two ectal glands in addition to the mass of fused cells around the orifice, but these are not shown in his figure (Bell 1962, fig. 3). Bell also noted a hemispherical chamber within the penial bulb which could not be detected in mounted specimens from Florida. Other differences in Bell's specimens are a shorter brain, about half as long as wide, irregular-shaped coelomocytes (possibly resulting from poor fixation) and nephridia with a large preseptale and an efferent duct that arises terminally but is folded back to give the impression of leaving subterminally or even near the septum. This latter character cannot be considered significant since in sectioned material it can be difficult to tell whether the distal portion of the nephridial duct is folded inside or outside the sheath of the postseptale. Bell did not mention lobes on the esophageal glands, which are not present in other known species of *Bryodrillus*, the dimensions of the sperm funnel, or the presence of a seminal vesicle.

Habitat and distribution.—University of West Florida, Pensacola, in drier parts of a hardwood swamp and an adjoining wooded ravine, mainly above the level of periodic flooding. Soil a moist, spongy humus with numerous fine roots, pH 3.5–4.5. Canada (Nova Scotia).

Genus *Hemienchytraeus*
Černosvitov, 1934

Hemienchytraeus species possess a median, unpaired, bifurcated peptonephridium

arising from the dorsal wall of the pharynx, which is unique in the Enchytraeidae. Other useful characters are setae in pairs; absence of esophageal or intestinal diverticula; nephridia with large preseptale enclosing the nephrostome; long sperm ducts usually coiled into a spirals; small, compact penial bulbs and free spermathecae each of which has an ectal duct without glands at the opening and a simple ampulla without diverticula.

Distribution.—*Hemienchytraeus* species were the most abundant and widespread enchytraeids in West Florida, especially in moist or wet habitats. Preliminary sampling in Peninsular Florida (unpublished) indicates that the same is true there. The genus is mainly tropical; only one species is recorded from Europe and is uncommon. Europe, India, Japan, Africa, South America.

Hemienchytraeus stephensoni

(Cognetti, 1927)

Fig. 5, A–I

Enchytraeus cavicola Stephensen, 1924
(non Joseph 1880):127–129, Pl. 6, figs. 1–4.

Enchytraeus stephensoni Cognetti, 1927:4.

Enchytraeus myrmecophilus Černosvitov,
1930a:85–89, figs. 1–9.

Enchytraeus rangoonensis Stephensen,
1931:177–179, fig. 1.

Hemienchytraeus stephensoni (*E. cavicola*
= *E. stephensoni* + *E. myrmecophilus* +
E. rangoonensis) Černosvitov, 1934:298–
304, figs. 1–11.

Hemienchytraeus stephensoni Černosvitov
1939:92–93, figs. 43–49; Christoffersen
1979:40–46, figs. 1–23; Nakamura 1984:
32–33, Fig. 1B, C, F; Dózsa-Farkas
1989:200–202, figs. 24–33.

Material examined.—Five stained, whole mounts, USNM 170741–170745, four stained, whole mounts ROMIZ 13239–13240, 13246–13247; 30 stained, whole mounts in the author's collection. Approximately 50 live specimens examined.

Description of new material.—Small to

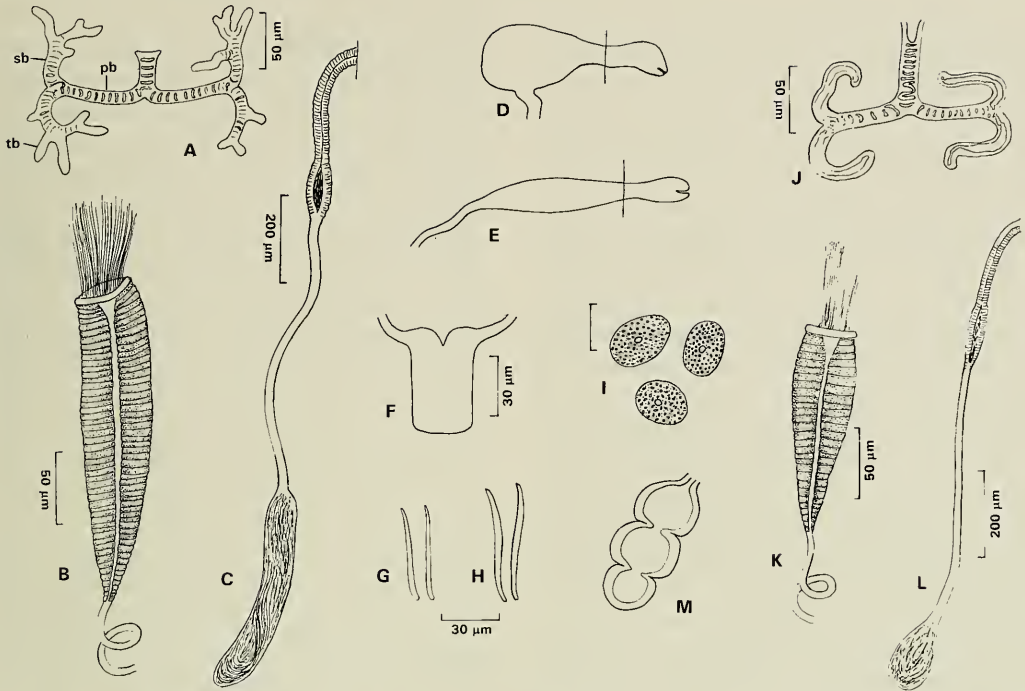


Fig. 5. *Hemienchytraeus stephensoni*. A, peptonephridium; B, sperm funnel, live worm; C, spermatheca; D, preclitellar nephridium; E, postclitellar nephridium; F, brain; G, anterior setal bundle; H, posterior setal bundle; I, coelomocytes. *Hemienchytraeus bifurcatus*. J, peptonephridium, K, sperm funnel, live worm; L, spermatheca. *Buchholzia fallax*. M, esophageal gland in IV. pb primary branch, sb secondary branch, tb tertiary branch.

medium-sized worms, live specimens rather transparent, with a prominent clitellar region due to presence of large eggs. Live specimens 8–10 mm, fixed specimens 6–9 mm, diameter 0.2–0.3 mm, 0.24–0.38 mm at clitellum. Segments 36–48 ($\bar{X} = 44.1$, $SD = 2.7$, $n = 29$). Setae two per bundle, occasionally three, with weak ental hook. Setae absent in XII. In anterior region setae straight or slightly curved and rather small, 32–40 μm long, more curved, thicker and longer in posterior half of worm, 50–62 μm in terminal segments (Fig. 5G, H). Cutaneous gland cells small and inconspicuous, in about four rows per segment. Prostomium with numerous dark-staining gland cells. Clitellum over XII– $\frac{1}{2}$ XIII, gland cells small, arranged in more or less regular transverse rows, especially in ventral region and on anterior and posterior borders of clitellum. Glands may be absent mid-ventrally. Head pore near tip of prostomium. Some

specimens were in mucus tubes encrusted with particles of organic matter.

Three pairs of pharyngeal glands, all united dorsally and with ventral lobes. Peptonephridium arises from dorsal side of pharynx in III, proximal portion of variable length, thick-walled with a coiled or sinuous lumen, primary and secondary branches narrower but also with coiled lumina (Fig. 5A). Each secondary branch divides into three to five thin-walled, finger-like processes. Entire peptonephridium confined to IV. Chloragocytes from V, form a dense layer from VII, 11–13 cells across intestine in preclitellar region in compressed specimens. Transition between esophagus and intestine gradual with enlargement behind pharyngeal glands. In all specimens collected from the Pensacola region in 1993, a section of the intestine behind the clitellum, usually between XIV–XVI and XXVIII–XXX, was enlarged and brown in colour. In

other specimens, the brown region was reduced or absent. Coelomocytes sparse, of various sizes and shapes, but mainly round, 8–18 μm , almost hyaline in live individuals, faintly granular with a distinct nucleus in fixed specimens (Fig. 51). Dorsal vessel originates in XIII, usually with isolated, yellow, dendritic cells on surface of vessel (seen in live worms); anterior bifurcation at 0/1. Blood colorless. Nephridia with large, ovoid preseptale that encloses a dorsally directed nephrostome, postseptale of variable shape, usually ovoid in preclitellar segments where duct arises mid-ventrally and elongated in posterior segments where duct is sub-terminal or terminal (Fig. 5D, E). First nephridium at 6/7. Brain about 1.5 times longer than wide, deeply indented or even cleft on its anterior border, posterior border sinuous or straight (Fig. 5F).

Testes compact. Small, paired seminal vesicles usually present in XI. Sperm funnels funnel-shaped, somewhat flattened, 190–360 μm long, 40–112 μm wide, somewhat longer than diameter of worm, generally six to eight times longer than wide in live specimens, with collar about same width or slightly narrower than rest of funnel (Fig. 5B). Funnels taper to spirally coiled ducts 5–6 μm in diameter, which open at small, compact penial bulbs, longitudinal diameter 54–82 μm . Male pores curved slits. One to three large eggs present at a time, contained in an egg sac that extends to 14/15 or rarely 15/16. Spermathecae with long, thick-walled ectal ducts, 12–18 μm in diameter, outer surface rough, which swell to form sperm-containing chambers in V or VI, continue as smooth, thin-walled tubes, and terminate in thin-walled, cylindrical ampullae in VI–IX (Fig. 5C). Length of spermathecae variable; ampullae may be twice or several times longer than wide, swollen and occupying up to 2½ segments when mature.

Remarks.—*Hemienchytraeus stephensoni* is a very variable species, hence the number of nominal species synonymised by Černosvitov (1934). The variability has

been commented on by Černosvitov (1939), who noted differences in the length of the basal part of the peptonephridium and in the form and complexity of the septal (pharyngeal) glands in South American specimens. Christoffersen (1979) distinguished four types among Brazilian material from a single locality that differed in body length and width, setal length, pharyngeal glands, form of the peptonephridium, origin of dorsal vessel, number and shape of nephridia, form of the penial bulbs, length of sperm funnels and length of spermathecae and ampullae. He concluded that *H. stephensoni* is a complex of cryptic species. Two extreme forms were recognised among West Florida material that differed in lengths of setae, sperm funnels, spermathecal ampullae and the proximal section of the peptonephridium and in the form of the pharyngeal glands, but intermediates were also found. Size and segment number and dimensions of setae and sperm funnel are within the range of specimens from South America (Christoffersen 1979, Dózsa-Farkas 1989) and Japan (Nakamura 1984), but specimens differ in having both secondary and tertiary branches to the peptonephridium and in the presence of seminal vesicles. No individuals were found with more than two secondary branches on each side of the peptonephridium, as in material from Lake Titicaca (Černosvitov 1939) and Ecuador (Dózsa-Farkas 1989). In spite of Christoffersen's ability to recognise distinct types within a region, and the differences between material from Florida and South America, I believe *H. stephensoni* to be one variable species with a wide ecological tolerance and a wide geographic range.

Habitat and distribution.—*Hemienchytraeus stephensoni* was by far the most common enchytraeid in the region and was recorded from all localities and most kinds of inland habitat.

Pensacola, woodland, swamp, edge of a pond, floodbank of a river and boggy area, Avalon Peninsula, pitcher plant (*Sarracenia*) bog; Ponce de Leon, woodland at edge

of a stream; Lakewood, edge of a lake; Marianna, woodland on limestone and bank of a river; Torreya State park, woodland on limestone; Port St. Joseph, edge of roadside ditch. pH range 3.6–7.2.

Mainly tropical. South America (Argentina, Paraguay, Brazil, Bolivia, Ecuador), India, Burma, Central Africa, Japan. Recorded from almost every conceivable terrestrial habitat including woodland, grassland, tree bark, anthills, bat guano and the marine littoral zone. New for North America.

Hemienchytraeus bifurcatus

Nielsen & Christensen, 1959

Fig. 5J–L

Hemienchytraeus bifurcatus Nielsen & Christensen 1959:45, figs. 23–27.

Hemienchytraeus bifurcatus Nakamura 1984:31–32, fig. 1A, D, E.; Kasprzak 1986:178, figs. 639–643.

Material examined.—Three stained, whole mounted specimens USNM 170746–170748; one stained whole mount ROMIZ 13248; seven stained whole mounts in the author's collection. Approximately 28 live specimens examined.

Description of new material.—Medium to small worms, live specimens 4–6 mm, transparent when viewed microscopically, with a prominent clitellar region due to presence of rather large eggs. Fixed length 4–6 mm, diameter 0.3–0.4 mm, 0.3–0.45 mm at clitellum. Segments (25)29–44 (\bar{X} = 35.2, SD = 4.9, n = 20). Setae straight or slightly curved with a weak ental hook, two per bundle throughout, absent in XII, 32–58 μ m. Cutaneous glands small, indistinct. Clitellum over XII– $\frac{1}{2}$ XIII with small gland cells arranged in more or less transverse rows or sometimes irregularly, smaller or absent in mid-ventral region. Head pore near tip of prostomium. Some specimens were in mucus tubes with adhering debris and soil.

Three pairs of pharyngeal glands, all lobed and united dorsally. Peptonephridium

arises from mid dorsal region of pharynx in III, proximal section of variable length, branching dichotomously into two primary and four secondary branches (Fig. 5J). Proximal part of unpaired section hollow and contractile in live specimens, distal section and primary branches stout with a coiled or sinuous lumen, secondary branches thin-walled with a wide lumen. Entire peptonephridium confined to IV. Chloragocytes from V, forming a dense layer from VII. Esophageal-intestinal transition gradual, gut expands behind pharyngeal glands. Coelomocytes sparse, of various shapes and sizes, dominant type round or oval, 10–14 μ m, nucleated, granular. Dorsal vessel originates in XIII or XIV, anterior bifurcation at 0/1. Blood colorless. Nephridial preseptale large, postseptale egg-shaped with postero-ventral efferent duct in preclitellar region, more elongated with terminal or sub-terminal duct behind clitellum. Nephridia starting at 4/5 or 5/6, absent X–XVI. Brain rectangular, about 1.5 times longer than wide, deeply indented or even cleft on its anterior border, more or less truncated posteriorly.

Small, paired seminal vesicles usually present, sometimes only developed on one side. Sperm funnels funnel-shaped, three or four times longer than broad in live worms, 100–150 μ m in length, equal to $\frac{1}{3}$ or $\frac{1}{2}$ diameter of worm, with a collar equal to or slightly narrower than rest of funnel (Fig. 5K). Funnels taper to long, spirally-coiled ducts in XII, open at small, compact penial bulbs, about 32 μ m across. One to three large eggs present at a time, egg sac extending to XIV. Spermathecae long, each consists of a fairly stout, thick-walled ectal duct, without glands at the orifice, duct swells to form a sperm-containing chamber in V or VI and then extends as a thin-walled tube to an ovoid or spherical ampulla situated in any of segments VI–IX, usually in VII (Fig. 5L).

Remarks.—This species, like the previous one, is very variable, especially in size, form of the nephridia and lengths of sper-

mathecae and sperm funnels. The different dimensions of the reproductive organs are not related to stage of maturity, for individuals with sperm in the ampulla may have long or short spermathecae and either short or long sperm funnels. Danish specimens (Nielsen & Christensen 1959) differed in having a brain indented posteriorly, nephridia with terminal efferent ducts, coelomocytes with refringent granules, no seminal vesicle and a sperm funnel only 2–3 times longer than wide. A longer sperm funnel was also reported in Japanese specimens (Nakamura 1984).

The species is similar in general appearance to *H. stephensoni* but is generally smaller and has somewhat more granular coelomocytes, more noticeable in live specimens. The two species often occurred together and although the form of the peptonephridium is quite different, this was sometimes difficult to see clearly. Mature individuals could be reliably distinguished by the greater dimensions of the spermathecal ampulla and sperm funnel in *H. stephensoni*, as noted by Nakamura (1984).

Habitat and distribution.—Not as abundant, nor as widespread as *H. stephensoni*. Pensacola, woodland leaf litter at the University of West Florida, grass cuttings at Scenic Hills golf course; Avalon Peninsula, pitcher plant (*Sarracenia*) bog; Ponce de Leon, woodland soil and leaf litter; Marianna, woodland soil and leaf litter on limestone. pH range 3.9–6.9. Denmark, France, Japan, India. New for North America.

Genus *Henlea* Michaelsen, 1889

The principal diagnostic characters of the genus are straight or slightly curved setae, usually of unequal size within a bundle, the outer ones longer, esophagus expands abruptly into the intestine (with the possible exception of the sub-genus *Hepatogaster*), esophageal appendages present, intestinal diverticula present or absent, a preclitellar origin of the dorsal vessel, usually in VIII or IX, and nephridia with free nephrostome

and anterior origin of the efferent duct, often described as “*Henlea* type” but not unique to that genus.

Cosmopolitan: E and W of North America, S America, Europe, Siberia, Africa, Antarctic.

Henlea perpusilla Friend, 1911
aug. Černosvitov 1937b

Henlea perpusilla Friend, 1911:466–467.

Henleanella perpusilla Friend, 1913a:89.

Henlea bisetosa Friend, 1914:135.

Henlea inusitata Friend, 1913a:83–84.

Henlea minima Friend, 1913a:84.

Henlea nivea Černosvitov, 1930b:88, figs. 3–6.

Henlea perpusilla Friend 1913b:270–271, figs. 34–35; Černosvitov 1937a:194–196, figs. 2–5; Nielsen & Christensen 1959: 58–59, figs. 46, 47; Kasprzak 1986:256–257, figs. 992–996.

Material examined.—Two stained, whole mounts USNM 170749–170750; two stained whole mounts in the author’s collection. Live specimens examined, 27.

Remarks.—The large number of synonyms that are now recognised reflects a wide variation in size and morphology (Černosvitov 1941, Nielsen & Christensen 1959), which is partly explained by the existence of different cytotypes (Nielsen & Christensen 1959). Size of the live specimens (6–8 mm) and segment number (30–33) of Florida material are within the range of European specimens.

Habitat and distribution.—Common in Marianna State Park, deciduous woodland on limestone, sandy humus, sandy alluvial deposits and humus with limestone fragments; Tall Timbers Research Station, live oak forest, dark, sandy loam and leaf litter. pH range 5.5–7.1. Absent from the west of the study area. Canada (Cornwallis Is., Prince of Wales Is., Devon Is., Rocky Mountains), Greenland, Europe, Lebanon, Siberia, Japan, Antarctic, Bolivia.

Henlea ventriculosa
d'Udekem, 1854

Enchytraeus ventriculosus d'Udekem, 1854:
863, figs. 1, 4, 6–9.

Henlea multispinosa Friend, 1913a:85.

H. (Udekemiana) ventriculosa Černosvitov,
1930b:75.

Henlea groenlandica Černosvitov, 1929:
146, figs. 1, 2.

H. (Udekemiana) groenlandica Černosvitov,
1930b:75.

Fridericia stewarti Stephenson, 1909:109.

Henlea ventriculosa Michaelsen, 1889:31–
32, 1900:69–70; Nielsen & Christensen
1959:62, figs. 50, 53, 57; Kasprzak 1986:
264–265, figs. 1028–1030.

Material examined.—Two stained, whole
mounts USNM 170751–170752; three
stained, whole mounts in the author's col-
lection. Five live specimens examined.

Remarks.—Size, 5–8 mm when fixed,
and segment number (38–44) of Florida in-
dividuals are within the range of European
specimens but the spermathecae have shorter
ectal ducts, about equal to the length of
the ampullae, while each ental duct is longer
than the combined lengths of ampulla
and ectal duct. In addition, there are several
small glands at the ectal opening. Danish
specimens lacked these glands, the ectal
duct was longer and the ental duct shorter
(Nielsen & Christensen 1959). In spite of
these differences, the species could be iden-
tified with confidence by the characteristic
gut diverticula.

Habitat and distribution.—Marianna
State Park, deciduous woodland on lime-
stone, rotting wood, leaf litter, humus with
limestone fragments. pH range 5.3–6.7.
Canada (Cornwallis Is., Prince of Wales
Is.), USA (Massachusetts, N. Carolina), Eu-
rope, Siberia, Tibet, Japan, New Zealand, S.
America.

Genus *Buchholzia* Michaelsen, 1887

The genus is recognised by the following
unique combination of characters: sigmoid

setae, decreasing in size within bundles to-
ward the dorsal and ventral midlines of the
body; hollow esophageal appendages in IV;
transition between esophagus and intestine
abrupt with one or two dorsal diverticula at
7/8; anteclitellar origin of the dorsal vessel
in the region of the intestinal diverticula;
and small, hyaline, anucleate coelomocytes
in addition to the normal kind.

So far, confined to the northern hemi-
sphere but not recorded from Asia. Canada,
Europe, N. Africa.

Buchholzia fallax Michaelsen, 1887
(Fig. 5M)

Buchholzia fallax Michaelsen, 1887:374–
376, pl. 21, fig. 4A–E.

Buchholzia fallax Beddard, 1895:334–335;
Michaelsen 1900:72–73; Černosvitov
1928:9; Ude 1929:57–58; Nielsen &
Christensen 1959:65, figs. 59–61; Wilcke
1967:72, fig. 6A, B; Kasprzak 1986:117–
118, figs. 294–298, table 8.

Material examined.—Two stained, whole
mounts USNM 170753–170754; ten whole
mounts in the author's collection. Live
specimens examined, 18.

Remarks.—Distinguished from *B. appen-
diculata* (Buchholz, 1862), which was re-
corded from Montreal by Nurminen
(1973b), by the presence of one, rather than
two, intestinal diverticula and only three in-
stead of four pairs of pharyngeal glands,
and by having male organs in the usual po-
sition for enchytraeids. All specimens ex-
amined are small, 4–7 mm compared with
12–14 mm for specimens from Denmark
(Nielsen & Christensen 1959). Segments
30–38 (Danish material 37–42). A seminal
vesicle is usually present, stated to be ab-
sent by Nielsen & Christensen and not men-
tioned by Michaelsen (1887). The pulsating
esophageal appendages in IV are of a dif-
ferent shape from those figured by Nielsen
& Christensen (1959:143, fig. 60); they are
elongate with partial cross walls dividing
the cavity into three compartments (Fig.
5M), rather than rosette-like. The small,

secondary cavities in the spermathecal ampulla, figured by Michaelsen, could not be seen and have not been mentioned by other authors. Some specimens were inside mucus tubes encrusted with rings of soil particles.

Habitat and distribution.—Common in Marianna State Park, deciduous woodland on limestone. A few in a similar habitat in Torreya State Park. pH range 5.5–7.1. Absent from the west of the study area. Europe, N. Africa. New for North America.

Acknowledgments

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